

REMARKS/ARGUMENTS

Favorable reconsideration of this application is respectfully requested in light of the following discussion.

Claims 1-36 are pending, Claims 6, 7, 9, 10, 13, 14, 16, 17, 21, 22, 24, 25, 28, 29, 31, 32, and 36 having been amended by way of the present amendment.

In the outstanding Office Action the Abstract was objected to, the claims were objected to; Claim 36 was rejected under 35 U.S.C. 112, first paragraph; Claim 36 was further rejected under 35 U.S.C. 112, second paragraph; Claims 1, 2, 17 and 32 were rejected as being anticipated by Grubb et al. (U.S. Patent No. 6,282,002, hereinafter "Grubb et al."); Claims 3-31 were rejected as being unpatentable over Grubb et al. in view of European Patent Application 11021142 (Emori et al., hereinafter "Emori"); Claims 11, 14, 26, 29, 33 and 34 were rejected as being unpatentable over Grubb et al. in view of Stentz et al. (U.S. Patent No. 6,163,636, hereinafter "Stentz"); Claims 35 and 36 were rejected as being unpatentable over Grubb et al. in view of Stentz and in further view of Emori.

In reply, the specification, namely the Abstract, has been amended as requested. The specification has also been amended to spell out "laser diode", for which the acronym LD corresponds. No new matter is added.

Claim 36 has been amended consistent with 35 U.S.C. 112. However, if the examiner disagrees the examiner is invited to telephone the undersigned so that mutually agreeable claim language may be identified.

Claim 1 is directed to Raman amplification method that includes three steps. First, a combination of optical powers is calculated at two or more different pumping wavelengths in backward pumping so as to provide a substantially flat Raman gain. The next step is to carry out bidirectional pumping with at least part of the pumping lights wherein the bidirectional

pumping includes the backward pumping. Finally, the method includes a step of changing the respective distribution of pumping power to wavelength of the bidirectional pumping.

An advantage with this approach is that noise figure in optical systems becomes larger as the transmission fiber becomes longer. While noise figure can be reduced by forward pumping, if there is an attempt to achieve too much gain while reducing noise figure solely by forward pumping the performance characteristics are degraded by other factors, including relative intensity noise (see e.g. specification, last paragraph at page 3). Furthermore, as neither forward pumping nor backward pumping solves the noise factors wavelength dependency, noise factor generally remains large on the short wavelength side where the transmission loss is large.

In view of the problem of “managing” noise figure in multi-pump Raman amplifiers, the present inventors recognized that it is possible to first calculate the respective pump powers of at least two backward pumping pumps so as to provide a substantially flat Raman gain. Then, after performing backward pumping, performing bidirectional pumping and changing the respective distribution of pumping power to wavelength of the bidirectional pumping. This allows for the maintenance of a flat gain and noise figure within a certain signal band as well as an ability to adjust noise figure depending on the distribution of wavelength within the pumping band (see e.g. specification, top of page 27). Furthermore, an advantage of the present invention is that when combining multiple Raman amplifiers, the noise figure may be adjusted to generally increase or decrease with respect to wavelength. Thus, the noise figure characteristic can be compensated for among plural Raman amplifiers in which the gain and noise figure are both flat with respect to an increase in wavelength (see e.g. specification, page 27).

Applicants respectfully traverse the rejection of Claim 1 based on Grubb et al. Claim 1 requires a step of calculating a combination of optical powers at two or more pumping

wavelengths. The Office Action asserts that dynamic controlling of pump energy “inherently includes calculating”. Applicants traverse this assertion. The claim specifically requires the calculation of a combination of optical power at two or more pumping wavelengths in backward pumping so as to provide a substantially flat Raman gain. In contrast, the controller in Grubb et al. (See e.g. column 6, lines 35-44) merely adjusts the output powers of the pumps in Grubb et al. It is not necessary to do any calculations and therefore, it is improper to assert that Grubb et al. “inherently” includes calculating.

Assuming *arguendo* that Grubb et al. does disclose calculating, Grubb et al. neither teaches nor suggests the additional features of carrying out bidirectional pumping followed by changing pumping power distribution over wavelength for bidirectional pumping. Grubb et al. does not distinguish between purposely changing from backward pumping, to bidirectional pumping, and then changing the respective distribution of pump power after bidirectional pumping is performed. Thus, it is respectfully submitted that Grubb et al. does not disclose the combination of steps, namely calculating optical power in backward pumping, then carrying out bidirectional pumping, and then changing the respective distribution of pumping power for the bidirectional pumping. As Claim 2 depends from Claim 1, it is respectfully submitted that Claim 2 patentably defines over Grubb et al. Likewise, Claims 17 and 32 are believed to patentably define over Grubb et al.

As Emori does not cure the deficiencies described above with regard to Grubb et al., it is respectfully submitted that no combination of Grubb et al. in view of Emori, can teach or suggest all of the elements of Claims 3-31 for substantially the same reasons as discussed above with regard to Claim 1.

Likewise, although of differing statutory class and/or scope, it is respectfully submitted that the assertion of Stentz does not cure the deficiencies discussed above with

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regard to Claim 1 for Grubb et al. Therefore, it is respectfully submitted that Claims 11, 14, 26, 29, 33 and 34 also patentably distinguish over the asserted prior art.

Claims 35 and 36, although of differing statutory class than Claim 1, also patentably define over Grubb et al. in view of Stentz and in further view of Emori for at least the same reasons discussed above with regard to Claim 1.

Consequently, in view of the present amended and in light of the foregoing comments, it is respectfully submitted that the invention defined by Claims 1-36, as amended, is definite, supported by the patent specification and patentably distinguishing over the prior art. The present application is therefore believed to be in condition for formal allowance and an early and favorable reconsideration of this application is therefore requested.

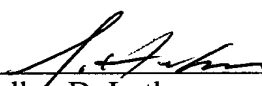
Respectfully submitted,

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